Dynamic Planet Test Answer Key

Problems worked out at the end

Team Name		Team Number	

1 Points for each correct answer 1 – 61.

1. A	**23.** C
2. B	**24.** C
3. C	**25.** D
4. C	**26.** C
5. B	**27.** E
6. A	**28.** D
7. D	**29.** E
8. E	**30.** D
9. E	**31.** E
10. E	**32.** E
11. B	**33.** A
12. C	**34.** C
13. E	**35.** B
14. D	**36.** A
15. A	**37.** D
16. A	**38.** E
17. D	**39.** D
18. D	**40.** E
19. C	**41.** A
20. E	**42.** C
21. A	**43.** B
22. B	**44.** F

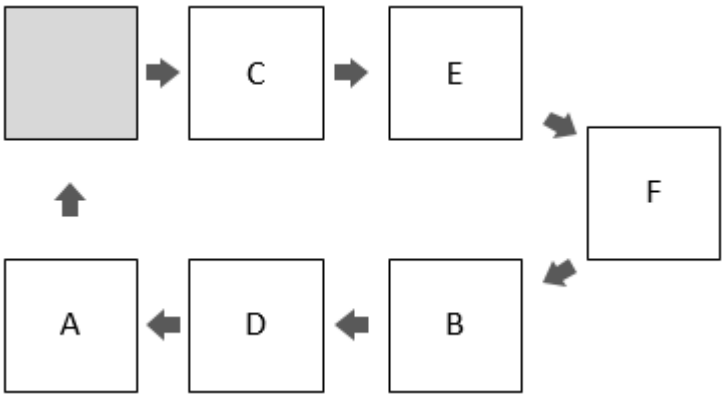
#	Fault Type	Boundary	Force	Movement
45.	B	A	A	B
46.	A	B	B	A
47.	C	C	C	C
48.	E	C	E	D
49.	D	C	D	E

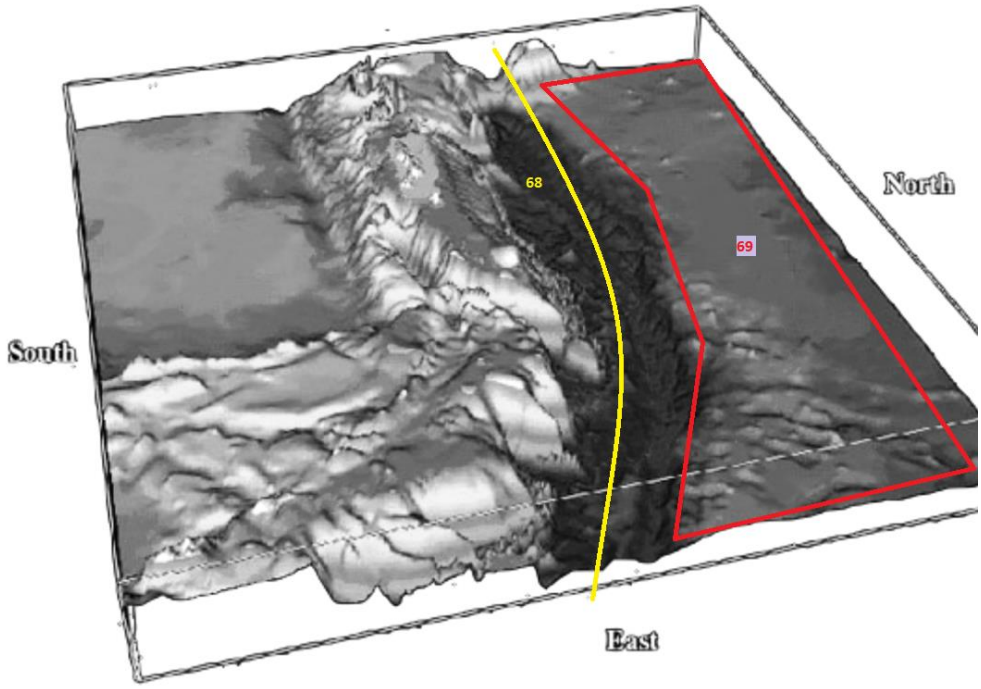
#	Type	Speed of process	Nature of Motion
50.	E	A	B
51.	A	A	B
52.	C	A	C
53.	D	C	A
54.	F	C	C
55.	B	B	B

#	Plate Boundary Type	Plate to Plate (choose Oceanic / Continental)
56.	transform boundary	continent – continent
57.	divergent boundary	continent – continent
58.	divergent boundary	oceanic – oceanic
59.	convergent boundary	oceanic – oceanic
60.	convergent boundary	Oceanic - continental

61.	convergent boundary	continental – continental

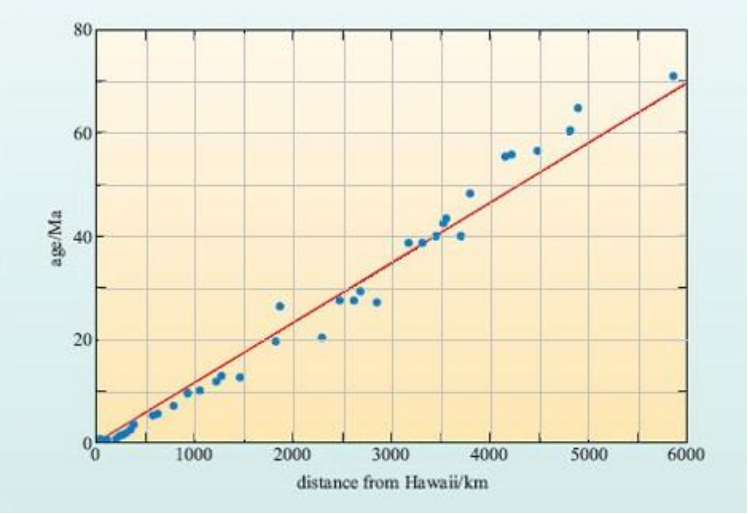
2 Points for each correct answer 62 - 75

62.	Earthquake
63.	2004
64.	
65.	1.15 km
66.	A. Trench
	B. Forearc
	C. Foreland
	D. Rift

67.	Convergent
68.	
69.	Plate on the North is being subducted
70.	Oceanic plate (deep below sea level), only oceanic plates can be subducted
71.	The other plate is also an oceanic plate, because a chain of islands has formed on its edge, but sea level drops again away from the boundary
72.	Magma forms during subduction, when the sinking plate and/or the mantle above it starts to melt. The magma rises up into, and eventually through, the over-riding plate. Lava spills out onto the seafloor, forming a line of undersea volcanoes. The largest volcanoes slowly grow above sea level, into an island chain.
73.	Approximately **0.5 km**
74.	About **2%** of the Earth's surface is above 4 km
75.	(71% - 38%) = **33%** of the Earth's surface lies between 1 and 5 km below sea level.

Detailed explanations

5. Graph shows age of seamount/island chain vs distance from Hawaii measured along the Hawaii-Emperor chain of islands and seamounts. A best-fit line has been drawn through the data.



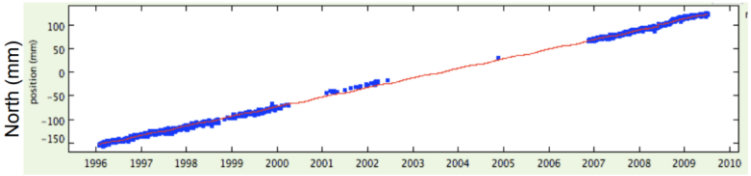
Estimate the average rate in mm/y at which volcanic activity has appeared to move along the Hawaiian-Emperor Seamount Chain.

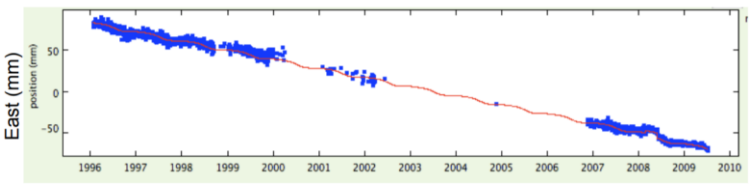
A. 8.8 mm/y
B. 88 mm/y
C. 880 mm/y
D. 8,800 mm/y
E. 880,000 mm/y

Graph is time/distance, speed = distance/time; inverse of the slope will give speed. Pick two points on the graph to calculate slope 1/((y2-y2)/(x2-x2)) = (6000 - 2500)/ (70 - 30) Km/Ma = 87.5 Km/Ma = 88 km/Ma for 2 significant figures. Acceptable answers are 87 or 88 Km/Ma = 87 or 88 mm/y

Questions 28 & 29:

Below is the GPS time series plot for REYK GPS station





28. What direction is HOFN moving?

A. North

B. East

C. Northeast

D. Northwest

E. Not enough information to interpret

29. Approximately, how fast was REYK moving over a period of 10 years from 1998 to 2008 in mm/yr?

A. 43750 mm/yr

B. 2326 mm/yr

C. 1225 mm/yr

D. 145 mm/yr

E. 23 mm/yr

East: Average position on 1/1/2008 = -50 mm, Average position on 1/1/1998 = 60 mm

Speed of REYK (east) = (-50 - 60) mm/10 years = -110 mm/10 yrs = 110 mm/10yr to the west = 11 mm/yr to the west

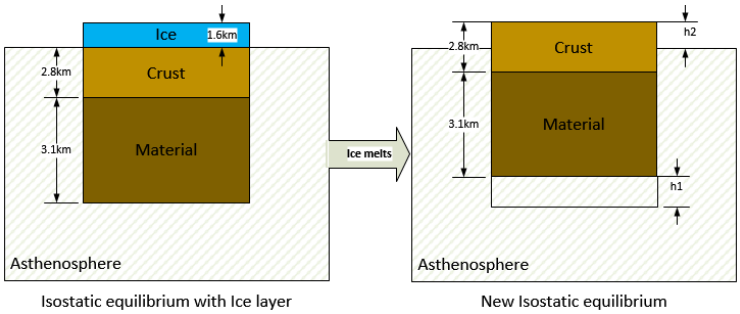
North: Average position on 1/1/2008 = 90 mm

Average position on 1/1/1998 = -115 mm

Speed of REYK north = (90 – -115) mm/10 years = 205 mm/10 yr = 20.5 mm/yr to the north

Using Pythagorean theorem, sqrt(x^2+y^2) yields 23.26 mm/yr northwest

65. A large area of continent consists of 30 km of crust with density 2.8 Mg/m^3 over 90km of material with density 3.1 Mg/m^3. This region is covered with a 1.6 km thickness of ice of density 0.9 Mg/m^3. The asthenosphere density is 3.2 Mg/m^3. The ice-covered region is assumed to be isostatic equilibrium. Then, the ice melts. By how much in km will the rock surface of the continent rise/drop when the new isostatic equilibrium is re-established?



Define layer densities: ρ_i=0.9 ρ_c=2.8 ρ_m=3.1 ρ_a=3.2 (units= Mg/m3)

Define layer thickness: t_i=1.6 t_c=30 t_m=90 t_a=infinite (units= km)

Define height variables: h1 is bottom layer offset, h2 is top layer offset

The height equation is: (90 + 30 + 1.6) = h1 + h2 + (30 + 90)

Which simplifies to: 1.6 = h1 + h2 (km)

The weight equation is: $t_i \rho_i + t_c \rho_c + t_m \rho_m = 0*h2 + t_c \rho_c + t_m \rho_m + h1 \rho_a$

Which simplifies to: ti ρi = h1 ρa (note that the common layers between the two blocks always cancel out!)

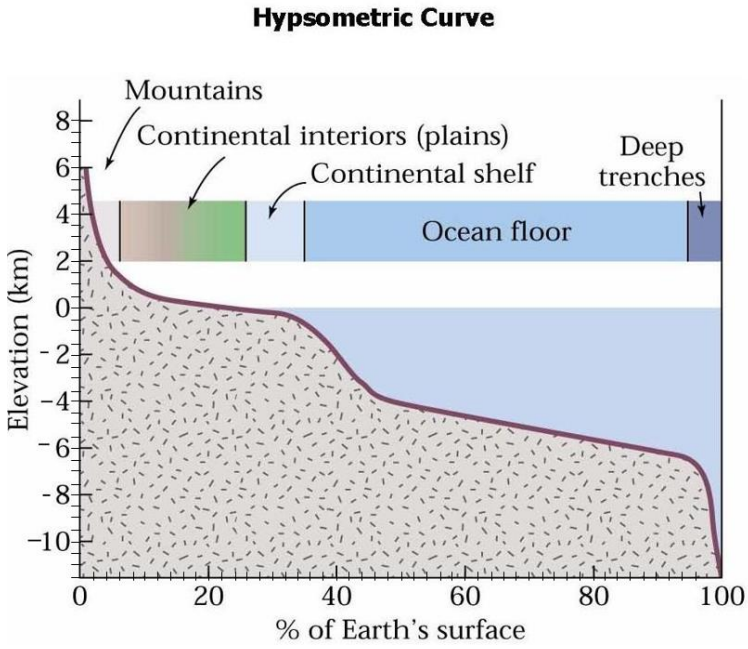
Solving for h1 gives: h1 = ti * (ρi / ρa) = 1.6 * (0.9/3.2) = .45 km

So h2 equals: h2 = 1.6 – h1 = 1.15 km

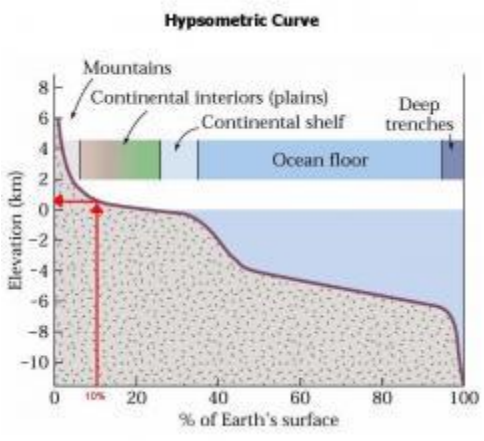
So, the answer is that the former rock-ice surface that is now the rock-air surface rose 1.15 km

upwards towards the sky

Using the hypsometric curve below, answer the following questions:

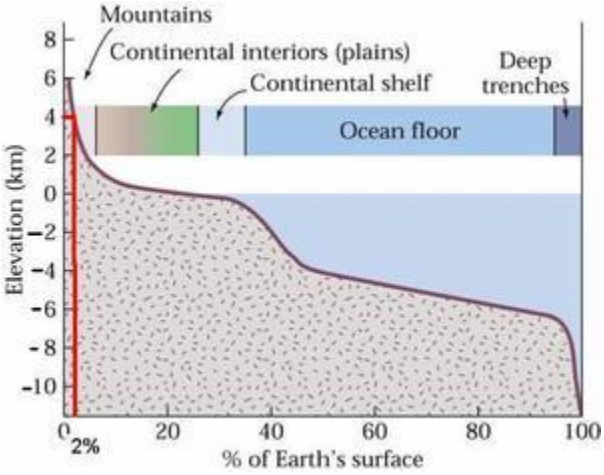


73. Determine the minimum elevation of mountains that make up the highest 10% of the Earth's surface.



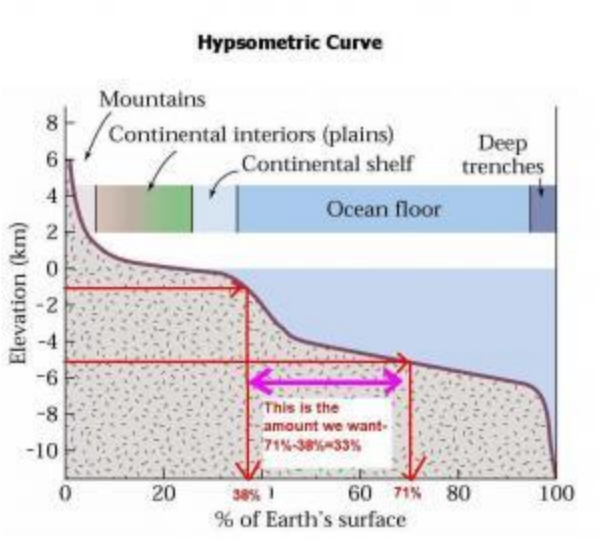
Approximately 0.5 km

74. Most plants cannot exist above 4 km above sea level. What percent of the Earth's surface is higher than this?



About 2% of the Earth's surface is above 4 km

75. Determine the percentage of the Earth's surface between 5 km below sea level and 1 km below sea level



71% - 38% = 33% of the Earth's surface lies between 1 and 5 km below sea level.